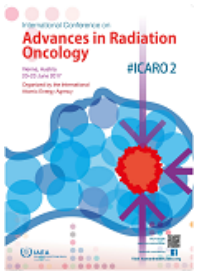

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Saturation correction for ionisation chambers at different DPP

Thursday, June 22, 2017 3:30 PM (5 minutes)

Introduction:
For the exact measurement of dose with an ionisation cahmber in radiotherapy it is essential to have knowledge of the dose per pulse (DPP) of the radiation beam and the saturation correction factor kS of the chamber with respect to the DPP. There are several methods for the determination of kS (i.e. Jaffé diagrams, 2 voltage methods with different formulas and a theoretical calculation model).

Methodology:
kS was determined for several ionisation chambers (Semiflex, PinPoint, Roos, advanced Markus) at increasing DPP in photon and electron beams at a conventional linac (Varian NovalisTx) and at a mobile intraoperative electron linac (LIAC). Measurements were performed in a water phantom or in a solid water phantom at different depths corresponding to a PDD-shaped DPP gradient. The focus was on the one hand on the visualisation of the difference in kS in different depths and the influence on dose calibration according to TRS-398 at a depth different than the dose maximum. On the other hand the focus was on the correct measurement of dose and DPP-independent measurement of PDDs with a suitable detector in high-DPP beams.

Results:
As expected, the values for kS for the different chambers are increasing with the DPP. For evaluation of the factor at very high DPP in the electron beams, a modified 2 voltage method has to be used because the standard methods are inconsistent in these dose regions. In the low DPP regions at the conventional Linac, all methods yield approximately the same chamberspecific values at the different DPPs. At the IOeRT linac, the use of the standard methods can result in very large deviations in kS and consequently in dose, the only suitable method is one including a model that accounts for a free-electron component. To reduce the relative deviation by applying kS, the highest applicable chamber polarisation voltage should be used to keep the correction factor as low as possible.

Conclusion:
When measuring absolute dose or percentage depth doses in a high energy radiation beam, one must be aware of the dose per pulse and how to determine the correspondent correction factor kS. The choice of a suitable detector is imperative to avoid possible devations between real and measured or calculated dose.

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